Solarlink GmbH
Drangstedter Str. 37
D 27624 Bad Bederkesa

GERMANY

mail: info@solarlink.de
web: www.solarlink.de

User Manual UM1

1600 | 1200 | 600

Automatic Charge Control

GB

1.1 Foreword

Thank you for purchasing an EFOY product. We hope that you will enjoy your new unit.

Please read these instructions first before using.

Should you have any questions about installation or operation, please consult your dealer or the EFOY hotline.

SFC Smart Fuel Cell AG
Eugen-Saenger-Ring 4
D-85649 Brunnthal-Nord, Germany

Hotline:
0049 89 607 454-99
hotline@efoy.com

www.efoy.com

1.2 Safety Information

Read the instructions before operating and keep them nearby. Be sure to follow all directions in the manual.

Do not open unit or fuel cartridges. Do not use force to open cartridges and do not refill them. Any modifications to the unit may affect safe operation, will lead to a loss of license and will void the guarantee Use only original EFOY equipment.

Do not store unit and fuel cartridges at temperatures above 45° C. Do not operate at temperatures above 40° C. Keep away from heat and direct sunlight.

Store the unit where there is no danger of freezing, or use the automatic antifreeze feature.

Do not smoke when handling the unit or the fuel cartridges.
Keep away from heat and open flame.

There is a danger of fire if methanol leaks out following an accident, or if the unit or the fuel cartridge has been damaged. Keep away from open fire and make sure area is well ventilated. Small amounts of methanol which may leak out will evaporate without leaving any residue.

Keep unit and fuel cartridges (including empty or partially filled cartridges) out of children's reach.

Operate the unit only in accordance with instructions and keep operating area well ventilated. Do not block exhaust. Avoid inhaling exhaust fumes directly or for prolonged periods of time.

There is no risk of coming into contact with methanol provided that you handle the unit and fuel cartridges in accordance with instructions.

We are required by law to print the following notice.

Methanol is toxic if inhaled, ingested or if it comes into contact with skin. Irreparable damage may occur if inhaled, ingested or if it comes into contact with skin. In the event of an accident or if nausea occurs, consult a physician immediately. Be sure to bring the fuel cartridge label or these instructions to the consultation. (A caution concerning methanol can be found in the appendix.)

System exhaust may contain harmful components. Avoid inhaling exhaust directly or for prolonged periods of time. Use the exhaust hose to conduct exhaust gases to the exterior.

Improper use or improper connection to other electrical devices may result in damage.

In addition to these safety instructions, please observe the passages in bold type. Otherwise, you may endanger yourself and others.

1.3 Normal Operation

The EFOY 600, EFOY 1200 and EFOY 1600 are automatic charging devices for 12V lead batteries.

The unit may be used only to charge lead batteries that conform to the specifications in Chapter 3.4, S. 12).

The specifications allow for solid-state operation (see Chapter 3.4) on boats and motor vehicles. Operate only with original-equipment EFOY fuel cartridges.

The unit is not intended for emergency medical power generation, or for powering life-sustaining or agricultural devices.

Do not operate unit if housing is damaged.

1.4 Declaration of Conformity

CE

SFC Smart Fuel Cell AG, Eugen-Sänger-Ring 4, 85649 Brunnthal-Nord declares that the EFOY 600, EFOY 1200 and the EFOY 1600 conform to the European Community's 89/336/EWG guidelines for electro-magnetic compatibility. The following norms apply: DIN EN 61000-6-1, DIN EN 61000-6-3

1.5 Seals of Approval

E 24

These units have been tested in accordance with ECE Regulation No. 10 for electro-magnetic compatibility. Operation in motor vehicles is permitted.

Approval number: E24 10R-020234

1.6 Disposal

Packaging

Packaging protects your unit during shipping. All materials used are environmentally compatible and recyclable.

We recommend saving the packaging for eventual winter storage.

Should you nevertheless wish to dispose of the packaging, please do so properly.

Your dealer or your local recycling center can provide information about proper disposal.

Danger of Suffocation!

Keep packaging away from children. Plastic wrapping and cartons may cause suffocation.

Fuel Cartridges

Sort empty fuel cartridges with plastics. Dispose of partly filled fuel cartridges in the same manner as solvents or paint.

Old Units

Old units are still valuable! Proper disposal can yield valuable raw materials while protecting the environment.

Your dealer or the EFOY hotline:

Tel.: 0049 89 607 454-99

can advise you about returning old units.

2. Table of Contents

1. Introduction 3
- 1.1 Foreword 3
- 1.2 Safety Information 4
- 1.3 Normal Operation 6
- 1.4 Declaration of Conformity 6
- 1.5 Seals of Approval 6
- 1.6 Disposal 7

2. Table of Contents 8

3. Configuration 9
- 3.1 Standard Equipment 9
- 3.2 Overview 9
- 3.3 Remote Control 10
- 3.4 Specifications 11

4. Installation 13
- 4.1 Space Requirements 13
- 4.2 Securing 15
- 4.3 Connecting the Exhaust Hose 16
- 4.4 Off-heat duct 17
- 4.5 Electrical Connections 18
- 4.6 Connecting the Remote Control 19
- 4.7 Select Language 21

5. Operation 22
- 5.1 Connecting the Fuel Cartridge 22
- 5.2 Automatic Operation 24
- 5.3 Switching on the Fuel Cell 25
- 5.4 Display Information 25
- 5.5 Remote Operation 27
- 5.6 Parallel Operation of Multiple Units 27
- 5.7 Switching Off the Fuel Cell 28
- 5.8 Automatic Antifreeze Feature 28
- 5.9 Storage 29

6. Maintenance 31
- 6.1 Service 31
- 6.2 Cleaning 31

7. Troubleshooting 32
- 7.1 Safety 32
- 7.2 Problems and Solutions 32
- 7.3 Problems without Error Messages 34
- 7.4 Changing the Fuse 35
- 7.5 Replacing Service fluid 36

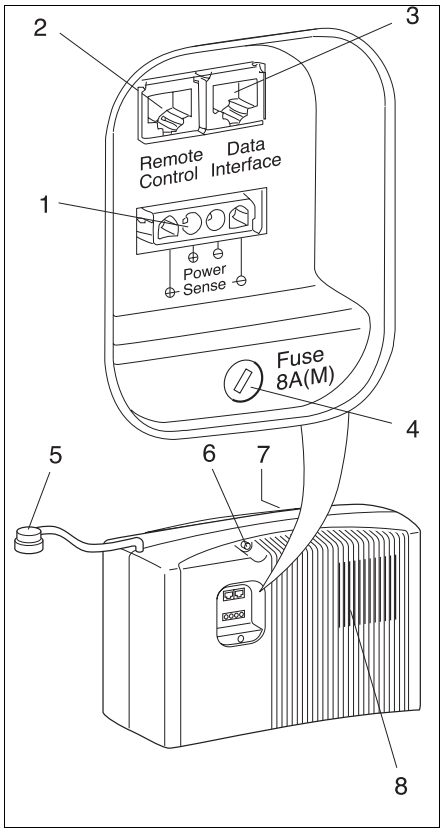
8. Appendix 37
- 8.1 Accessories and Spare Parts 37
- 8.2 Output characteristic 39
- 8.3 Material safety data sheet methanol 40

3.1 Standard Equipment

The following is standard equipment:

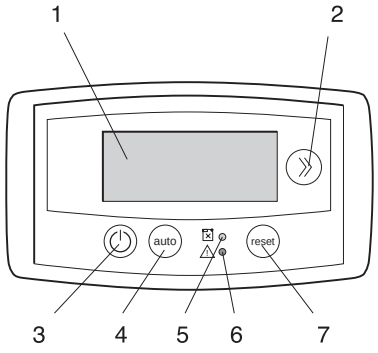
- unit
- RC1 remote control with data line
- FH 1 fuel-cartridge holder with belt
- MP 1 mounting plate with belt
- EH 1 exhaust hose (1.5 m)
- Charge line
- Service-Kit
- UM1 user manual

3.2 Overview



1 Charge line connection
2 RC 1 remote-control connection
3 Data interface
4 G-fuse 250V 8A M, 5 x 20 mm
5 fuel-cartridge connection
6 connection for EH 1 exhaust hose and nozzle for service fluid
7 cooling inlet (reverse)
8 warm-air outlet and connection for off-heat duct

3.3 Remote Control



1 Display
2 Information button and language-selection button ››
3 On/Off button ⏻
4 Button for automatic operation auto
5 Yellow warning light “Please change fuel cartridge“
6 Red error warning light
7 Reset button reset

3.4 Specifications

Performance

Product	**EFOY 600**	**EFOY 1200**	**EFOY 1600**
Rating	25 W	50 W	65 W
Charge capacity	600 Wh/Day (50 Ah/Day)	1200 Wh/Day (100 Ah/Day)	1600 Wh/Day (130 Ah/Day)
Nominal voltage	12 V	12 V	12 V
Charging current @ 12 V	2.1 A	4.2 A	5.4 A
Turn on threshold*	U_{batt} < 12.5 V	U_{batt} < 12.5 V	U_{batt} < 12.5 V
Cut off threshold*	U_{batt} >14.2 V and I_{out} < 2.0 A	U_{batt} >14.2 V and I_{out} < 2.0 A	U_{batt} >14.2 V and I_{out} < 2.0 A
Required starting voltage	> 10.8 V	> 10.8 V	> 10.8 V
Quiescent current requirement	15 mA	15 mA	15 mA
Methanol requirement	1.1 l/kWh	1.1 l/kWh	1.1 l/kWh
Compatible batteries	12 V rechargeable (lead-acid or lead-gel) batteries with 40 to 200 Ah capacity		

General Specifications

Sound pressure level at 7 m	23 dB(A)
Dimensions (L x W x H)	43.5 x 20 x 27.6 cm
Weight	7.5 kg

Environmental conditions

Space requirement (L x W x H)	51 x 35 x 30 cm minimum	
Inclination along the direct axis	continual:	35°
	temporary (<10 min):	45°
Inclination along the quadrature axis	continual:	20°
Operating temperature	-20 to +40 °C	
Start temperature	+5 to +40 °C	
Storage temperature	+1 to +45 °C	

* factory setting

Instrumentation

Operation	via remote control with four buttons and multilingual display
Electrical interface	MNL 4-prong plug
	Type Tyco Electronics AMP Universal Mate-N-Lok (Mfr. No. 350779)
Fuse	G fuse 250V 8.0A M, 5 x 20 mm

Securely fasten unit and fuel cartridges when using on board motor vehicles and boats.

Do not operate unit if there is danger of explosion.

Unit is not watertight. Make sure that no water can enter.

Keep unit and fuel cartridges away from children, temperatures in excess of 45° C and direct sunlight.

4.1 Space Requirements

Please note when installing that operating temperature ranges between –20° C and +40° C.

This unit generates heat, thus requiring ventilation. Please take this into account when considering space requirements.

Provide for a vent opening measuring at least 10 cm across when installing. Use the off-heat duct (included) to remove warm air.

Install only in upright position. Use the mounting plate (included).

Make sure that the device does not exceed the maximum inclination.

Inclination along the direct axis:	
continual:	35°
temporary (‹10min):	45°
Inclination along the quadrature axis:	
continual:	20°

4. Installation

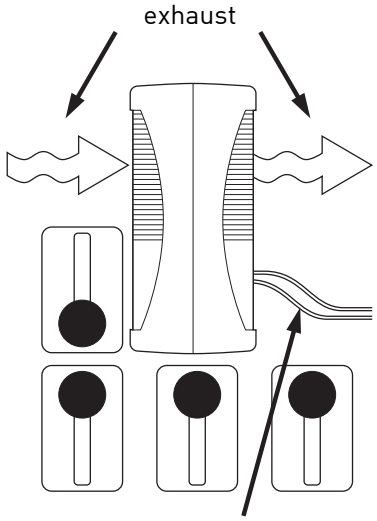
All electrical connections, the fill opening for service fluid and the fuel cartridge should be easily accessible.

Install unit and fuel cartridge at the same level.

Make sure that the fuel cartridge is located within reach of the connecting hose (30 cm) and that the hose is neither kinked nor crushed.

The fuel-cartridge hose and the exhaust hose may not be damaged. Do not substitute another hose for either of the two.

Use only original-equipment EFOY hoses.



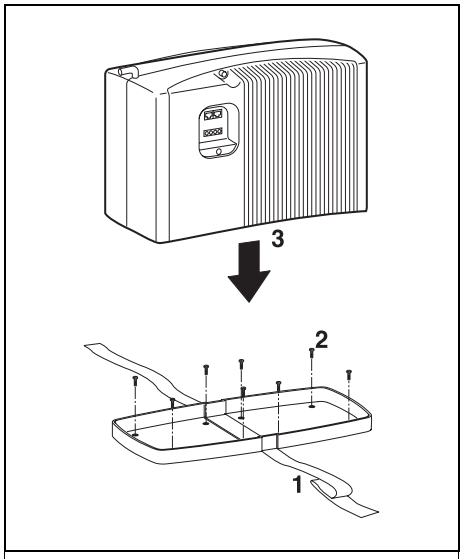
Do not place the fuel cartridge in front of the air intake or the exhaust!

Place fuel cartridges next to or in front of the unit as illustrated.

Do not place any other objects such as reserve fuel cartridges in front of intakes or the exhaust outlet.

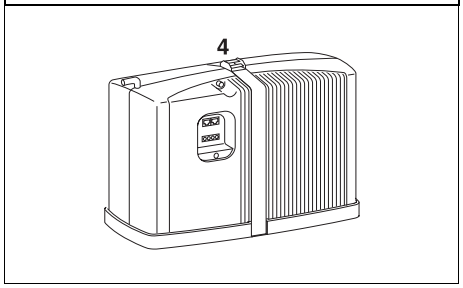
4.2 Securing

Securing the unit



Select a suitable location as described in Chapter 4.1, paying attention to the dimensions in Chapter 3.4 Specifications.

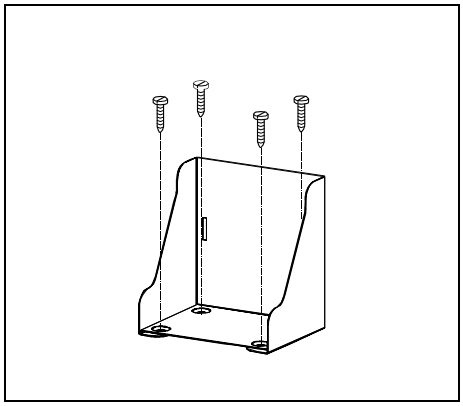
1. Run the belt in the groove under the mounting plate.
2. Secure the mounting plate tightly to the desired location. Use proper screws and dowels, if necessary, so that the mounting plate cannot shake loose in an accident, for example.
3. Place the unit onto the mounting plate.



4. Strap the unit tightly to the mounting plate.

Securing the fuel-cartridge holder

Keep fuel cartridge and reserve cartridges away from children, heat and out of direct sunlight.

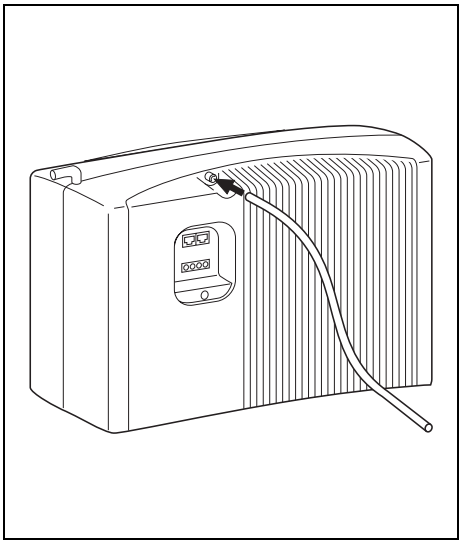


Select a suitable location for the fuel cartridge and reserve cartridges as described in Chapter 4.1 “Space requirements“.

Install device and fuel cartridge on the same level.

Secure the fuel-cartridge holder with four suitable screws and dowels, if necessary, so that it does not shake loose in an accident, for example.

4.3 Connecting the Exhaust Hose



The unit converts methanol and oxygen into water and carbon dioxide. The process generates heat, which together with water vapor, carbon dioxide and trace amounts of methanol, must escape.

Attach the exhaust hose (included) to conduct by products to the exterior.

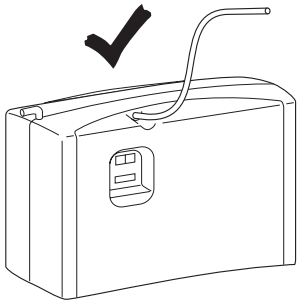
- Remove the cap from the exhaust port. Retain the cap for winter storage or for possible returns.
- Attach the exhaust hose (included) to the exhaust port.
- Feed the hose from the chassis to the exterior and use a suitable sealant to seal the opening. The hose may be shortened as needed.
- Make sure the exhaust hose has no kinks or blockage and that exhaust can escape freely.

Exhaust gasses contain moisture and may exceed 60° C, thereby causing scalding. Exhaust byproducts may contain injurious substances. Avoid inhaling exhaust directly or for long periods of time.

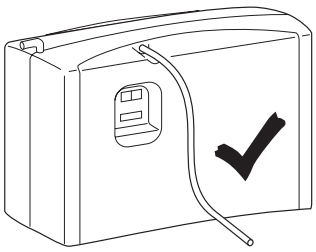
At no time may siphoning occur in the hose. Make sure that the hose is neither closed nor blocked.

The exhaust hose may not be longer than 50 cm in order to prevent freezing in winter. The hose may be up to 150 cm long for summer operation and during transitional seasons.

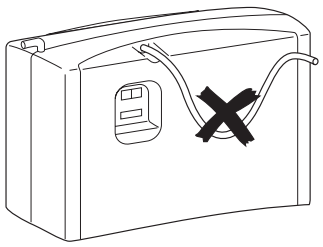
Routing the exhaust hose



Up



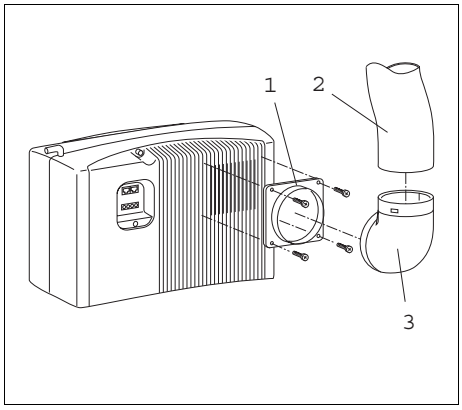
Down



Avoid siphoning

4.4 Off-heat duct

The off-heat duct (included) extracts warm air so that the unit can also be operated in close quarters.



1. Off-heat flange
2. Off-heat tube
3. Off-heat bow

Fasten the off-heat flange (1) to the unit using the pre-sunk screw holes. Attach the off-heat tube (2) to the off-heat bow and conduct the tube to the exterior. Should the off-heat bow (3) not be needed, you can remove it from the off-heat flange and attach the off-heat tube directly to the flange.

Make sure that the hose is not crimped and that there is no moisture or foreign objects inside. The hose may be shortened as needed.

It may be necessary to use an external face plate to protect the outlet.

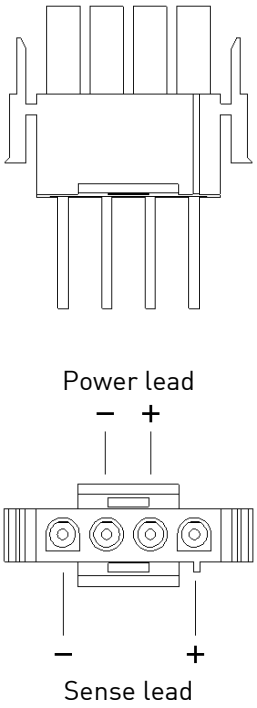
4.5 Electrical Connections

All work should be carried out by qualified technicians in accordance with technical regulations.

Improper connections or the use of wrong gauge wires could result in fire.

All wires must be properly insulated and have adequate voltage rating. All connections must be tight. The use of uninsulated wires and contacts is not permitted.

Use the battery charging line (included). The circuit connecting the battery must contain a fuse. Alternatively, use the fuse (available as optional equipment) to connect the battery.



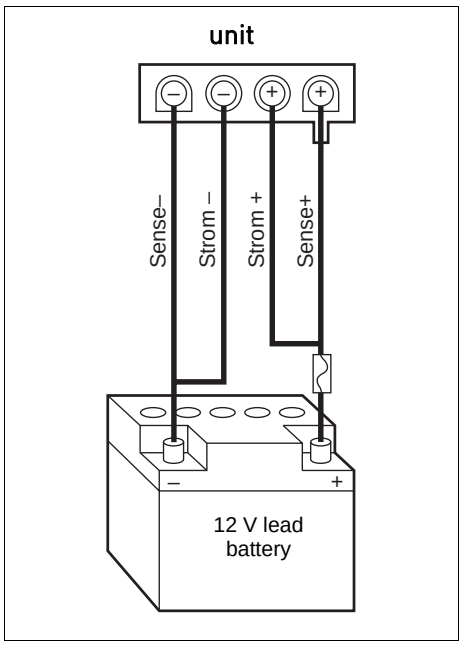
The battery charging cable consists of four leads that must be connected to the battery as follows:

Power lead:
This lead carries current to the battery.

Sense lead:
This lead measures battery voltage.

To minimize current loss in the leads, the following cross section is recommended, should the battery charging cable, included as standard equipment, be insufficient:

Length [m]	min. cross section
‹ 5 m	2.5 mm²
5 – 10 m	4 mm²
10 – 15 m	6 mm²



Make sure that the polarity is correct (see illustration).

Connect the positive wire + and the positive sensor cord + to the battery fuse. Then connect the battery fuse to the battery's positive terminal.

Then connect the negative wire – and the negative sensor cord to the battery's negative terminal.

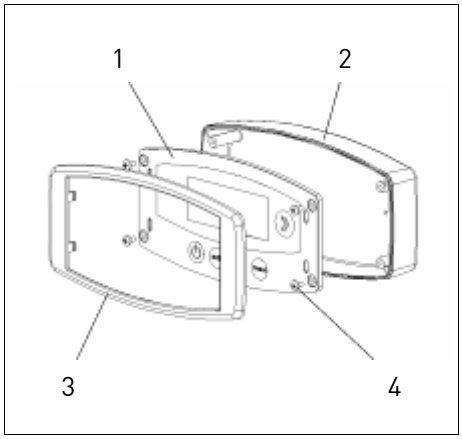
Installation in recreational vehicles (RV)

See IM1 installation manual for RVs with Electroblock (EBL).

4.6 Connecting the Remote Control

The remote control (1) displays the current status and is used to control the device. Mount the panel where it is easily accessible such as in the cockpit.

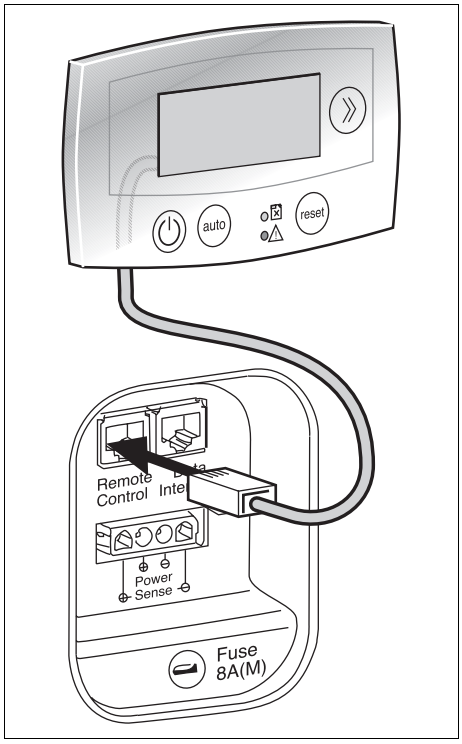
If installing the panel flush with the surface of the unit, make sure that there is sufficient opening for the electronic components behind the opening.



1 Control panel
2 Surface mount
3 Frame
4 Screws

Use templates for drilling and sawing when flush or surface mounting (2). Use a drill to start the opening and then cut out the rest of the opening with a keyhole or compass saw.

Then secure the control panel (1) with four suitable screws (4) and place the frame (3) over the control panel



Connect the control panel with the data line (included) or with any commercially available network cable such as a Cat. 5 patch cable.

Then insert the plug into the left socket on the unit marked “Remote Control“.

The display contains two lines with 16 characters apiece.

The first line provides information as to the operating mode selected:

Automatic
Standby

Automatic
On
Off

It also provides information as to the language selection. (See Chapter 4.7)

The second line provides information as to the operating status:

Standby
Charging mode
Antifreeze mode
Shutting down

The second line also indicates operating parameters such as charging current and such maintenance parameters as “Please change fuel cartridge“.

4.7 Select Language

- Press [››] on the control panel for 2 seconds. The control panel will display the language currently selected.

Deutsch

- The following languages are available:
  German (factory setting)
  English
  French
  Italian
  Dutch
  Spanish

- Continue pressing [››] until the desired language appears.
- Then hold [››] 2 more seconds in order to set your language choice.

5.1 Connecting the Fuel Cartridge

For safety's sake, use only original EFOY fuel cartridges. Do not smoke while changing the cartridge and avoid open flames! Do not expose fuel cartridges to temperatures above 45°C.

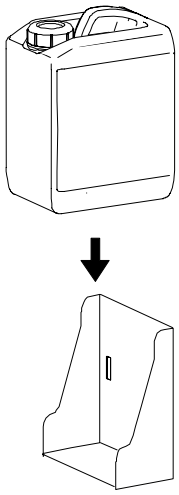
Do not place the fuel cartridge in front of the air intake or outlet.

Original-equipment EFOY fuel cartridges contain EFOY-approved methanol. Even slight impurities in commercially available methanol may cause permanent damage to the unit and may void the guarantee.

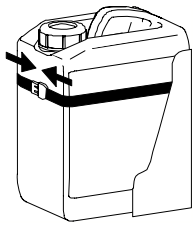
Note: When the cartridge is empty, "Please change fuel cartridge" will appear on the remote control and the yellow light will blink. The cartridge may be changed while the system is running.

- Unscrew the empty fuel cartridge and remove.
- Close each cartridge tightly with the cap after use.
- EFOY fuel cartridges are intended for one-way use only. They may not be refilled.
- Sort empty fuel cartridges with plastics. Dispose of partly filled fuel cartridges in the same manner as solvents or paint.

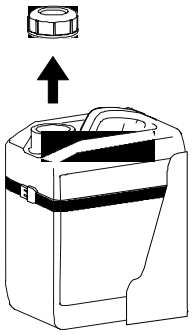
1



2



3



- Place a new sealed original-equipment EFOY fuel cartridge into the fuel-cartridge holder (1).
- **Fasten the belt on the fuel-cartridge holder (2). Do not attach fuel cartridges without a fuel-cartridge holder.**
- **Only remove the childproof cap when the new fuel cartridge has been placed into the fuel-cartridge holder (3).**
- Screw the connector onto the new fuel cartridge.
- Press reset on the control panel to extinguish the yellow warning light and the maintenance message.

5.2 Automatic Operation

Before connecting to the electrical system, make sure the unit has been positioned properly and that the electrical system is protected by fuses (as described in Chapter 4.5.)

Do not operate at temperatures above 40° C or below - 20° C. If device has been exposed to temperatures under 0° C without being connected to a battery or with insufficiently filled fuel cartridge (antifreeze), it must stand at room temperature for 24 hours before operating.

Make sure that a full fuel cartridge has been connected.

Automatic operation will begin the moment that you connect the unit to a battery. The unit will monitor battery voltage by itself.

Automatic
Charging mode

The unit charges the battery as needed or assists the battery in providing output. The second line of the display will indicate "charging mode" as long as the unit is providing voltage to the electrical system.

Automatic
Standby

If the battery is sufficiently charged and the unit is not providing input, the unit will remain in the standby mode.

Automatic
Please change fuel cartridge

Should the device detect a malfunction such as an empty fuel cartridge, it will shut down and advise you how to correct the situation. ("Please change fuel cartridge".) Resume automatic operation using the reset button after the error has been corrected. (See also Chapter 7 Troubleshooting).

5.3 Switching on the Fuel Cell

If desired, you can switch on the unit manually regardless of the battery voltage. The unit will then be in the "charging mode".

On
Charging mode

Press ⏻ on the control panel once if the unit has been switched off, and twice if it is operating in automatic mode. The unit will start up regardless of the battery voltage and will continue charging until it reaches the cutoff point
(U_{batt} ›14,2 V und I_{out} ‹ 2,0 A).

The device will then switch to automatic mode by itself and will only charge if the battery or the demand for power requires it.

5.4 Display Information

The second line of the display provides information about normal operation, errors or malfunctions (see Chapter 7). The first line indicates the operating mode selected, such as "Automatic".

Press ›› to obtain the following information.

Automatic
Voltage 13.6 V

- Battery voltage

Automatic
4.6 A

- Charging current

Automatic
Operating hours 500 h

- Total operating hours

Automatic
Energy 25000 Wh

- Total energy generated

Automatic
Firmware 1200 4.12L

- Firmware version

Automatic
Please change fuel cartridge

- Maintenance messages (see also Chapter 7)

Automatic
Charging mode

- If you have connected the optional cartridge sensor to your unit, a fuel cartridge will appear in the display as soon as a predetermined amount is reached.

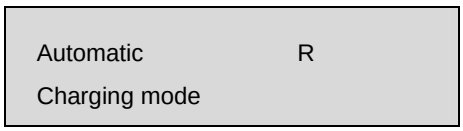
Always keep a reserve fuel cartridge at the ready. The cartridge need only be changed when the message “Please change cartridge“ appears in the display.

The standard display will be restored after about 30 seconds. Alternatively, you can return to the standard display by pressing [››] again.

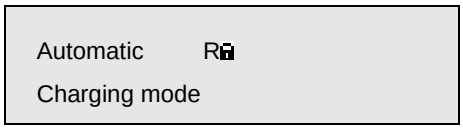
By pressing [››] for approximately 2 seconds, you will obtain the language menu (see Chapter 4.7 Select Language).

5.5 Remote Operation

The unit may also be controlled and monitored remotely. In order to do this, you will need either the CI1 control interface or the IA1 interface adapter. You can obtain both from your dealer.



An "R" for "remote" will appear in the first line when the unit is operating in remote mode.

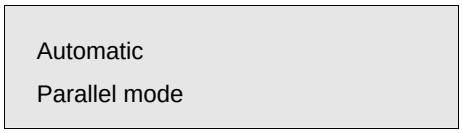


You can lock or unlock the unit's software from a remote location by pressing auto and ›› simultaneously. This will guarantee that the unit cannot be started by a remote signal.

If you have locked the software, a padlock will appear in the first line of the display.

5.6 Parallel Operation of Multiple Units

You can harness up to five units in parallel if increased output is needed. Use the optional CI1 control interface.



The manual that accompanies the control interface describes the installation and parallel operation of multiple units in detail.

Units running in parallel must all be in the same operating mode. For example, all have to be running in automatic mode. Be sure to press the same button on each control panel (such as reset to restart or auto for automatic mode).

Parallel mode will appear in the second line of the display.

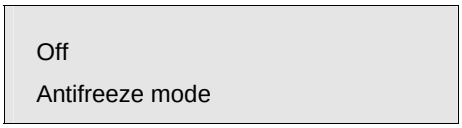
5.7 Switching Off the Fuel Cell

Press ⏻ on the remote control to switch off the device.

The unit will gradually shut down, performing various function checks as it does so:

To protect components, the unit must run at least 30 minutes before shutting down. If the unit is shut off beforehand, it will continue running until 30 minutes have elapsed. The message “Shutting down” will appear in the display. Leave the fuel cartridge and the battery connected during this time.

5.8 Automatic Antifreeze Feature



This unit features an intelligent antifreeze feature. The unit can keep itself warm at temperatures below 3° C as long as it is connected to a working battery and it is supplied with methanol.

If the unit is in antifreeze mode, the message “Antifreeze mode” will appear on the second line. The first line will indicate the current operating mode, for example “Off”.

The antifreeze function works only as long as a fuel cartridge and a sufficiently charged battery are connected.

The unit will not be able to start if the battery voltage falls below 10.5 volts. Please note that the unit will not recharge the battery if the voltage drops below 10.5 volts.

Please observe the following maintenance tips for storage and winter operation:

1 To cut energy costs, we recommend disassembling the unit and storing it away from cold if it is to be inactive for longer periods of time. Disassembly is easy; it requires just a few steps, no tools and no particular technical finesse. Store the unit in the original carton.

2 If, despite precautions, the unit does freeze, let it thaw in a warm place for approximately 24 hours before operating. Please note that the unit's performance may diminish if it freezes repeatedly.

Running in straight antifreeze mode, the unit will consume approximately 10 liters of methanol in the course of a five-month Central European winter.

5.9 Storage

- Press ⏻ on the remote control to switch off the unit.

Off
Shutting down

- Wait until the unit has shut down and the display has disappeared (approx. 30 min.).
- Unplug the charging line and the data line for the remote control.

- **Store the plugs and lines in a cool, dry place.**

  Do not smoke when handling unit and fuel cartridge. Keep away from open flame!

- Unscrew the fuel cartridge and close it with a cap. Keep all elements clean.

- **Keep unit and fuel cartridges – even empty or partially empty cartridges – away from children.**
- Remove the exhaust hose. Keep it clean and place a cap over the exhaust outlet.
- Remove the off-heat tube and the off-heat bow if necessary.
- Release the belt and lift the unit off the mounting plate.
- Store unit in a cool place; however, the temperature should exceed 1° C because the automatic antifreeze feature will only work if a fuel cartridge is attached along with a sufficiently charged battery. (See Chapter 5.8)
- If the unit has been exposed to temperatures below 0° C without being connected to a battery and sufficiently filled fuel cartridge (antifreeze), it will have to stand at room temperature for approximately 24 hours before operating.
- Use a proper box such as the original carton to ship the unit. Use padding to prevent shocks. Transport the unit in an upright position only.

6.1 Service

Do not open unit! Unauthorized tampering may jeopardize safe operation and void any guarantee. The unit does not contain any components that you can service or repair yourself.

The unit is maintenance free under normal operating conditions. Contact SFC if you intend to use it for other than its intended purpose.

SFC Smart Fuel Cell AG
Eugen-Saenger-Ring 4
D-85649 Brunnthal-Nord, Germany
Hotline: 0049 89 607 454-99
Fax: 0049 89 607 454-69
hotline@efoy.com

www.efoy.com

6.2 Cleaning

Switch off device before cleaning and unplug the battery charging cable.

The device is not watertight. Make sure that moisture cannot get inside.

Clean only with a soft cloth dampened with a mild detergent.

Reconnect the battery charging cable after cleaning so that the antifreeze feature remains activated. (See Chapter 5.8).

7.1 Safety

Do not open unit! It contains no components that you can repair yourself.

Contact SFC Smart Fuel Cell AG if you are unable to correct a malfunction using these instructions.

7.2 Problems and Solutions

The control panel signals problems via a red and/or yellow light and a running message on the second line of the display.

The messages will assist you in solving the problem quickly and easily.

Press the reset button on the control panel AFTER the problem has been solved.

Under no circumstances should you press the reset button repeatedly.

Message	Solution
Error 10: Please contact service	Call the hotline at. Tel.: 0049 89 607 454-99
Error 11: Please check exhaust hose	Check that the exhaust hose has been properly connected and arrange it so that condensation cannot form.
Error 12: Please check exhaust hose	Check for kinks. Clean hose if necessary and keep opening clear. Shorten exhaust hose if condensation forms.

Message	Solution
Error 20: Please change fuel cartridge	Insert a new fuel cartridge as described in Chapter 5.1. Check connection and screw cartridge on tightly.
Error 21: Please change fuel cartridge	Check cartridge hose for kinks. Check hose and connection for dirt. Position fuel cartridge on the same level as unit. Check connection and screw cartridge on tightly.
Error 30: Please refill service fluid	Check that exhaust can escape and that ambient temperature is below 40° C. Then add service fluid (see Chapter 7.6).
Error 40: Please defrost device slowly	Unit has been exposed to temperatures below 0° C without being connected to a battery and sufficiently filled fuel cartridge (automatic antifreeze feature). Let stand at room temperature for approx. 24 hours.
Error 50: Please check battery voltage	Battery voltage is too low. Check battery voltage. If under 10.5 V, use an external battery charger to recharge.
Error 51: Please check battery voltage	Battery voltage is too high. Check whether the battery is the proper type.
Error 52: Please check battery voltage	Battery voltage is too low. If battery voltage is under 10.5 V, check connection between unit and battery (see Chapter 4.5).

Message	Solution
Error 53: Please check battery voltage	Battery voltage is too high. Check whether the battery is the proper type. Check other charging devices such as generators or regulators for defects.
Error 63: Automatic restart	Unit is restarting automatically.
Interruption: Surroundings too warm	Ambient temperature is too high. Unit will start automatically as soon as temperature drops below 40° C.

7.3 Problems without Error Messages

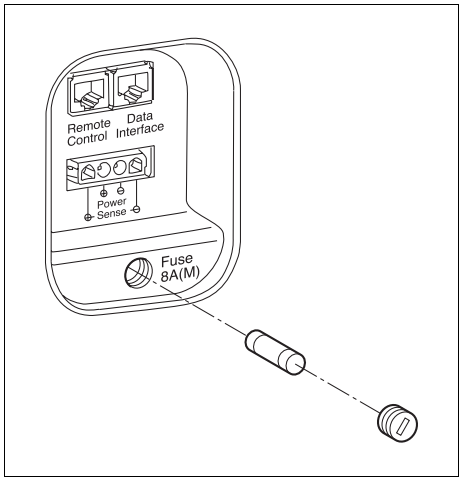
Description	Cause	Solution
Unit does not start.	No battery connected, wrong battery or undercharged.	Check contacts, polarity and cables. Connect a charged battery to start device.
	Short-circuit fuse tripped.	Check polarity of charge line. Turn off unit, check reason for short circuit/overload or wrong polarity and correct. Replace fuse (see Chapter 7.4).
	If problem recurs:	Contact the hotline at: Tel.: 0049 89 607 454-99

7.5 Changing the Fuse

Replace fuses only with fuses of the same type and rating. Never repair or override a fuse.

Before changing fuse, locate the reason for the malfunction and have your dealer repair it.

Switch off the unit before replacing the fuse. Unplug the charge line.



- Replace the fuse:

  G fuse 250V 8 A M, 5 x 20 mm

- Reconnect the charge line.

- Make sure that you have replacement fuses on hand. Replacement fuses are available in electronics stores or from your dealer.

7.6 Replacing Service fluid

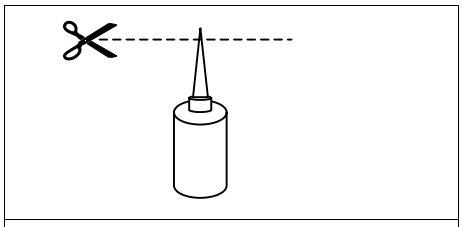
If service fluid is low the red light will come on and the message "Please refill service fluid" will appear in the control panel display.

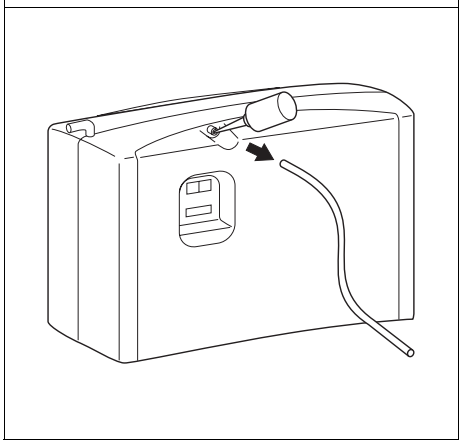
There is no need to add service fluid prior to the initial start-up.

Use EFOY brand service fluid only.

Switch off the unit before refilling fluid. Unplug the charge line.

Always keep the device's service fluid nozzle clean.





- Use a clean pair of scissors to cut off the tip of the cap.

  The service fluid bottle is for one time use only.

- Remove the exhaust hose from the device's service fluid nozzle.
- Insert the tip into nozzle and gently squeeze the entire contents into the nozzle.
- **Never refill more than one bottle of Service Fluid at a time.**
- Wipe off any spilled service fluid with a cloth.
- Replace the exhaust hose.
- Press the reset button. The display will clear and the device will return to its former operating mode.
- Order a spare bottle service fluid at your local dealer.

8.1 Accessories and Spare Parts

Use only original equipment!
Use of unauthorized parts compromise safety and void the guarantee.

Description	Item number
Fuel cartridge M5 (2)	150 905 006
Fuel cartridge M10	150 905 008
Fuel-cartridge holder with belt FH1	150 905 002
Belt for fuel-cartridge holder	150 905 007
Remote control with data line RC1	151 077 003
Frame for remote control	151 077 007
Surface mount for remote control	151 077 006
Data line DL1 (5 m)	151 075 003
Mounting plate with belt MP1	150 905 001
Belt for mounting plate	151 908 003
Charge line CL1	151 906 009
Charge line RV CL2	151 906 010
Exhaust hose EH1 (1.5 m)	000 999 674
Off-heat duct (flange, bow, tube, External face plate, fixing screws) OD1	151 903 001
Off-heat flange and Off-heat bow	151 903 005
Off-heat tube	151 904 001
External face plate	151 903 013
Screw for fastening off heat flange M4 x 10 (4 pieces)	000 992 629
User manual UM1	151 901 001
Installation manual for RVs IM1	151 901 006
G-fuse 250 V 8 A m, 5 x 20 mm (10 pieces)	151 906 001

8. Appendix

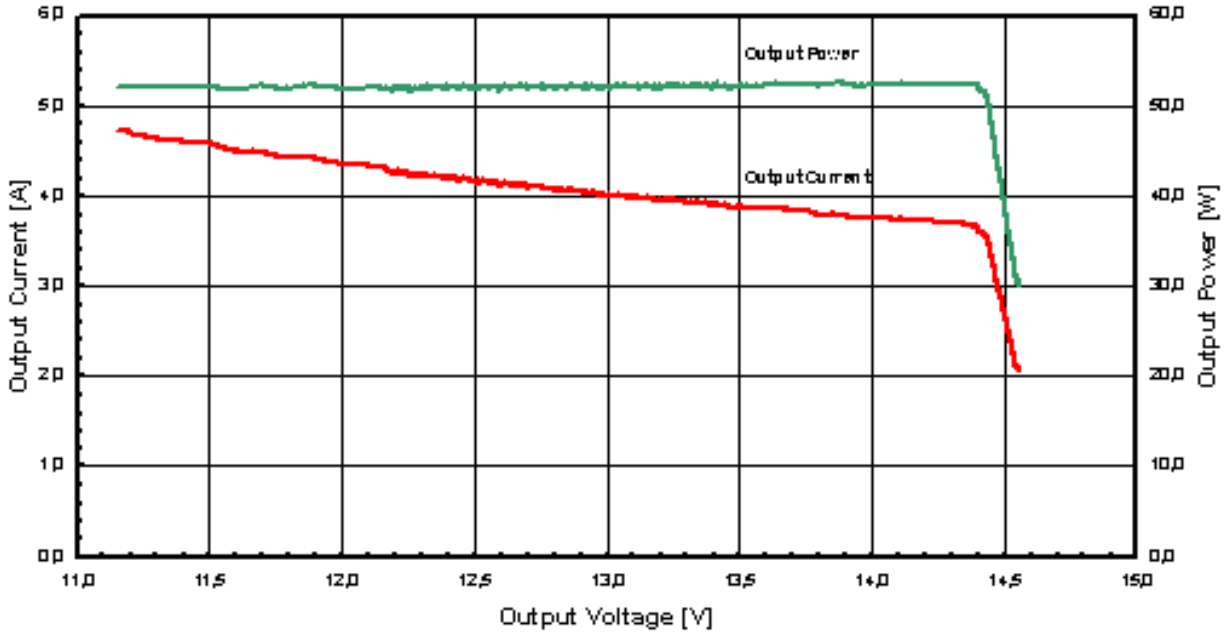
Description	Item number
Service-Kit	151 909 002
Control interface CI1	151 076 007
Interface adapter IA1	151 075 001

For further information on accessories and spare parts, please ask you dealer.

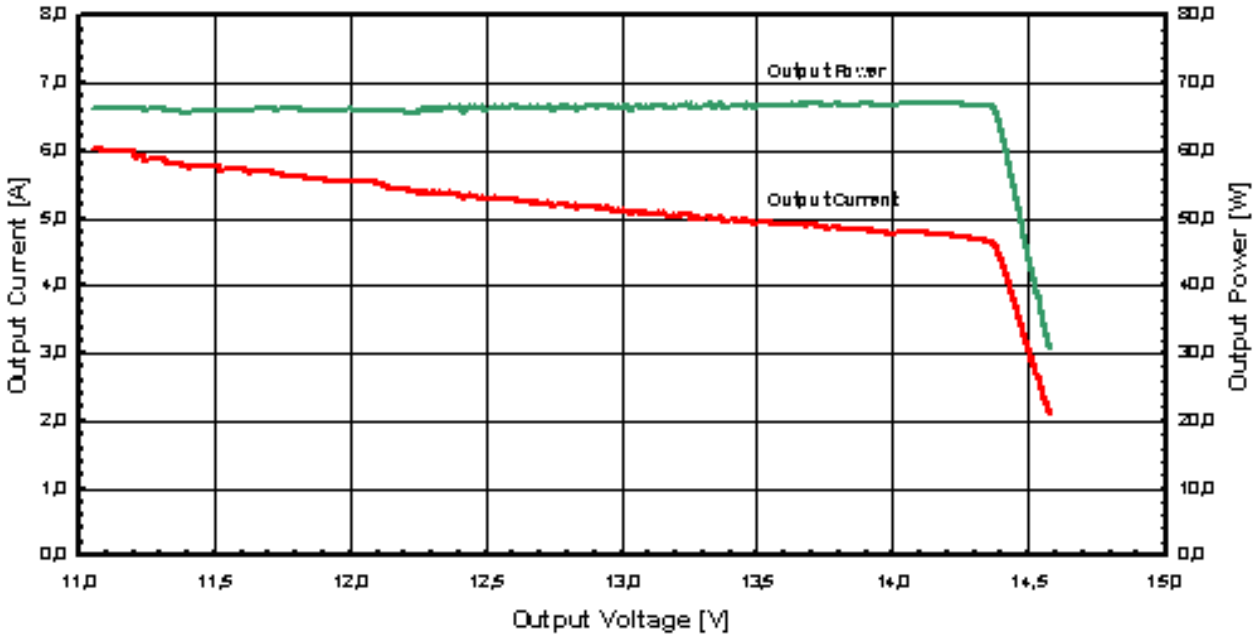
8.2 Output characteristic

U-I and U-P characteristic as per CE test

1200: U- I- and U- P- Characteristic



1600: U- I- and U- P- Characteristic



8.3 Material safety data sheet methanol

When working with methanol fuel cartridges, be sure to comply with the following safety data sheet.

In case of accident or nausea, immediately seek medical assistance and present this safety data sheet.

**Gemäß Richtlinie 91/155/EWG der Kommission
der Europäischen Gemeinschaften**

1. Identification of the Substances / preparation and the company

1.1 Identification of the substance or preparation:

Synonyms : Methyl alcohol, methyl hydrate, wood spirit, methyl hydroxide
Product use : Solvent, fuel, feedstock

CAS no. :	000067-56-1		
EC index no. :	603-001-00-X	**NFPA code :**	1-3-0
EINECS no. :	200-659-6	**Molecular weight :**	32.04
RTECS no. :	PC1400000	**Formula :**	CH3OH

Company/undertaking identification:
SFC Smart Fuel Cell AG
Eugen-Sänger-Ring 4
D- 85649 Brunnthal-Nord
Tel.: +49 (0) 89 607 454 99
Fax.: +49 (0) 89 607 454 69

Telephone number for emergency:
(+32) 14-58 45 45
Information centre of dangerous goods (B.I.G.)
Technische Schoolstraat 43A, B-2440 Geel, Belgium

2. Composition / information on ingredients

Hazardous ingredients	CAS no.	Conc in %	Hazard class.	Risks (R-phrases)
METHANOL	000067-56-1	99.85	F;T	11-23/24/25-39/23/24/25

3. Hazards identification

- Toxic by inhalation, in contact with skin and if swallowed
- Toxic: danger of very serious irreversible effects through inhalation, in
- contact with skin and if swallowed
- Highly flammable
- May build up electrostatic charges: risk of ignition
- Gas/vapour flammable with air within explosion limits

4. First Aid measures

4.1 Eye contact:

- Rinse immediately with plenty of water for a minimum of 15 minutes, ensuring
- all surfaces and crevices are flushed by lifting lower and upper lids
- Consult a doctor/medical service

4.2 Skin contact:

- Remove clothing before washing
- Wash immediately with lots of water/soap for 15 minutes
- Consult a doctor/medical service if irritation occurs

4.3 After inhalation:

- Remove the victim into fresh air
- Restore or assist breathing if necessary
- Consult a doctor/medical service

4.4 After ingestion:

- Swallowing methanol is life threatening
- Onset of symptoms may be delayed for 18 to 24 hours after ingestion
- If conscious and medical aid is not immediately available, do not induce
- vomiting
- Transport to medical attention

5. Fire-fighting measures

5.1 Suitable extinguishing media:

- Small fires: Powder, carbon dioxide, halon, water spray, Standard foam
- Large fires: Water spray, AFFF(R)(Aqueous Film Forming Foam (alcohol
- resistant)) type with either a 3% or 6% foam proportioning system

5.2 Unsuitable extinguishing media:

- N.D.

5.3 Hazardous Decomposition Products:

- Toxic gases and vapours; carbon monoxide, carbon dioxide and formaldehyde

5.4 Instructions:

- Methanol burns with a clean clear flame, which is almost invisible in daylight
- Keep upwind, mark the danger area
- Concentrations of greater than 25% methanol in water can be ignited
- Cool tanks/drums with water spray and remove them into safety
- Take account of toxic firefighting water
- Use firefighting water with moderation, contain it if possible

5.5 Special protective equipment for firefighters:

- Fire fighters must wear full face, positive pressure, self-contained breathing apparatus or airline and appropriate protective clothing
- Protective fire fighting structural clothing is not effective protection from methanol. Do not walk through spilled product as it may be on fire and not visible

6. Accidental release measures

6.1 Personal protection:

- see 8.3

6.2 Environmental precautions:

- Prevent soil and water pollution
- Substance must not be discharged into the sewer

- Plug the leak, cut off the supply
- Dam up the liquid spill
- Try to reduce evaporation
- Recover methanol or dilute with water to reduce fire hazard

6.3 Clean-up:

- Eliminate all ignition sources
- Fluorocarbon alcohol resistant foams may be applied to spill to diminish vapour and fire hazard
- Maximize methanol recovery for recycling or reuse
- Collect liquid with explosion proof pumps
- For small spills: take up into non-combustible sorbent

7. Handling and storage

7.1 Handling:

- Reduce/avoid exposure and/or contact
- Keep container tightly closed
- No smoking or open flame
- Use spark-/explosionproof appliances and lighting system
- Take precautions against electrostatic charges
- Handle uncleaned empty containers as full ones

7.2 Storage:

- Keep away from heat and ignition sources, oxidizers, acids, bases
- Store in a dry and well-ventilated area
- Store in totally enclose equipment
- Tanks must be grounded and vented and should have vapour emission controls
- Provide for a tub to collect spills

7.3 Materials for packaging:

- Anhydrous methanol is non-corrosive to most metals at ambient temperatures except lead and magnesium
- Coatings of copper (or copper alloys), zinc (including galvanized steel) or aluminium are unsuitable for storage as they are attacked slowly
- Mild steel is the recommended construction material for tanks

8. Exposure controls/Personal protection

8.1 Recommended engineering controls:

In confined areas, local and general ventilation should be provided to maintain airborne concentrations below permissible exposure limits
Ventilation systems must be designed according to approved engineering standards

Sampling methods:
NIOSH 2000

8.2 Exposure limits:

TLV-TWA :		mg/m3	200	ppm
TLV-STEL :		mg/m3	250	ppm
TLV-Ceiling :		mg/m3		ppm
OES-LTEL :	(266)	mg/m3	(200)	ppm

OES-STEL :	(333)	mg/m3	(250)	ppm
MAK :	270	mg/m3	200	ppm
TRK :		mg/m3		ppm
MAC-TGG 8 h :	260	mg/m3		
MAC-TGG 15 min. :		mg/m3		
MAC-Ceiling :		mg/m3		
VME-8 h :	260	mg/m3	200	ppm
VLE-15 min. :	1300	mg/m3	1000	ppm
GWBB-8 h :	266	mg/m3	200	ppm
GWK-15 min. :	333	mg/m3	250	ppm
Momentary value :		mg/m3		ppm
EC :	260	mg/m3	200	ppm
EC-STEL :		mg/m3		ppm
Odour threshold :			2000	ppm

(irritation at 1000 ppm; poor olfactory warning properties)

Sampling methods:
NIOSH 2000 / OSHA 91

8.3 Personal protection:

eye protection:
- Face shield and chemical splash goggles

hand protection:
- Gloves

skin protection:
- Protective clothing

materials for protective clothing:
- Butyl rubber
- Nitrile rubber

respiratory protection:
- Air respirator when airborne concentrations exceed exposure limits

9. Physical and chemical properties

9.1	**Appearance (at 20°C) :**	Clear liquid	
9.2	**Odour :**	Slight alcohol odour	
9.3	**Colour :**	Colourless	
9.4	**pH value :**	N.D.	
9.5	**Boiling point/boiling range :**	64.5	°C
9.6	**Melting point/melting range :**	-97.8	°C
9.7	**Flashpoint :**	11	°C (TCC)
9.8	**Auto-ignition point :**	385	°C
9.9	**Explosion limits :**	6/36	vol%

9.10	**Vapour pressure (at 20°C) :**	1278	hPa
9.11	**Relative density (at 20°C) :**	0.792	
9.12	Water solubility :	Completely	
9.13	Soluble in :	Ethanol, ether, acetone, chloroform	
9.14	Relative vapour density :	1.1	
9.15	Saturation concentration :	166	g/m3
9.16	Viscosity :	0.0006	Pa.s

10 Stability and reactivity

10.1 Stability:

- Stable under normal conditions

10.2 Reactivity/Hazardous decomposition products:

- Reaction with oxidizers, strong acids, strong bases
- May be corrosive to lead and aluminium
- Hazardous decomposition products: formaldehyde, carbon dioxide and carbon monoxide

11 Toxicological information

11.1 Acute toxicity:

LD50 oral rat :	5628	mg/kg
LD50 dermal rat :	N.D.	mg/kg
LD50 dermal rabbit :	15800	mg/kg
LC50 inhalation rat :	85	mg/l/4 h

The odour threshold of methanol is several times higher than the TLV-TWA

11.2 Chronic toxicity:

EC carc. cat.:	not listed
EC muta. cat.:	not listed
EC repr. cat.:	not listed
Carcinogenicity (TLV):	not listed
IARC classification:	not listed

11.3 Routes of exposure: swallowed, inhalation, eyes and skin

11.4 Acute effects/symptoms:

- Swallowing even small amounts of methanol may cause blindness or death Effects of sub lethal doses may be nausea, headache, abdominal pain, vomiting and visual disturbances ranging from blurred vision to light sensitivity
- Inhalation of high concentrations: irritation of the mucous membranes, headache, sleepiness, nausea, confusion, loss of consciousness, digestive and visual disturbances and death
- High vapour concentration or contact with liquid: irritation of the eyes, tearing and burning
- May be absorbed through the skin in toxic or lethal amounts

11.5 Chronic effects:

- Repeated exposure by inhalation or absorption: systemic poisoning, brain disorders, impaired vision and blindness

- Inhalation may worsen conditions such as emphysema or bronchitis
- Repeated skin contact may cause dermal irritation, dryness and cracking

Reproductive effects:

- Reported to cause birth defects in rats exposed to 20000 ppm

12 Ecological information

12.1 Ecotoxicity:

- LC50 (96 h) : 10800 mg/l (SALMO GAIRDNERI/ONCORHYNCHUS MYKISS)
- EC50 (48 h) : 24500 mg/l (DAPHNIA MAGNA)
- EC50 (72 h) : 8000 mg/l (ALGAE)

Methanol can be harmful for as well salt water organisms as freshwater organisms

12.2 Mobility:

- Volatile organic compounds (VOC): 100%
- Soluble in water

For other physicochemical properties see section 9

12.3 Persistence and degradability:

- biodegradation BOD5 : 0.6 - 1.1 g O2/g substance
  COD : 1.42 g O2/g substance
- water : Readily biodegradable in water(test: 99% OECD 301D. BOD 80% ThOD)
- soil : N.D.
- Methanol will be broken down to carbon dioxide and water

12.4 Bioaccumulative potential:

- log Pow : -0.82/-0.66
- BCF : < 10 (LEUCISCUS IDUS)
- Slightly bioaccumulative

12.5 Other adverse effects:

- WGK : 1 (Classification in compliance with Verwaltungsvorschriftwassergefährdender Stoffe (VwVwS) of 17 May 1999)
- Effect on the ozone layer : Not dangerous for the ozone layer(Council Regulation (EC) No.3093/94, O.J. L333 of 22/12/94)
- Greenhouse effect : No data available
- Effect on waste water purification : Sludge digestion is inhibited at800 mg/lNitrification of activated sludgeis inhibited at 160 mg/l; 50%

13 Waste disposal considerations

13.1 Provisions relating to waste:

- Waste material code (91/689/EEC, Council Decision 2001/118/EC, O.J. L47 of 16/2/2001): 07 01 04 (other organic solvents, washing liquids and mother liquors)
- Waste material code (Flanders): 001; 015; 034
- Waste code (Germany): 55315
- Hazardous waste (91/689/EEC)

13.2 Disposal methods:

- Incineration is the recommended disposal method
- Biological treatment may be used on dilute aqueous waste methanol

- Methanol wastes are not suitable for underground injection
- Waste materials must be disposed of in accordance with your municipal, state, provincial and federal regulations

13.3 Packaging:

- Waste material code packaging (91/689/EEC, Council Decision 2001/118/EC,O.J. L47 of 16/2/2001): 15 01 10 (packaging containing residues of or contaminated by dangerous substances)

14 Transport information

336
1230

14.1 Classification of the substance in compliance with UN Recommendations

UN-number :	1230
CLASS :	3
SUB RISKS :	6.1
PACKING :	II
PROPER SHIPPING NAME :	UN 1230, Methanol

14.2 ADR (transport by road)

CLASS :	3
PACKING :	II
DANGER LABEL TANKS :	3+6.1
DANGER LABEL PACKAGES :	3+6.1

14.3 RID (transport by rail)

CLASS :	3
PACKING :	II
DANGER LABEL TANKS :	3+6.1
DANGER LABEL PACKAGES :	3+6.1

14.4 ADNR (transport by inland waterways)

CLASS :	3
PACKING :	II
DANGER LABEL TANKS :	3+6.1
DANGER LABEL PACKAGES :	3+6.1

14.5 IMDG (maritime transport)

CLASS :	3
SUB RISKS :	6.1
PACKING :	II
MFAG :	19
EMS :	-
MARINE POLLUTANT :	-

14.6 ICAO (air transport)

CLASS :	3
SUB RISKS :	6.1
PACKING :	II
PACKING INSTRUCTIONS PASSENGER AIRCRAFT :	
PACKING INSTRUCTIONS CARGO AIRCRAFT :	

14.7 Special precautions in connection with transport

none

14.8 Limited quantities (LQ)

When substances and their packaging meet the conditions established by ADR/RID/ADNR in chapter 3.4, only the following prescriptions shall be complied with:
each package shall display a diamond-shaped figure with the following inscription:

- 'UN 1230'

or, in the case of different goods with different identification numbers within a single package:

- the letters 'LQ'

15 Regulatory information

Enumerated in substance list Annex I of directive 67/548/EEC et sequens

Highly flammable

Toxic

R11 :	Highly flammable
R23/24/25 :	Toxic by inhalation, in contact with skin and if swallowed
R39/23/24/25:	Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed
S(01/02) :	(Keep locked up and out of reach of children)
S07 :	Keep container tightly closed
S16 :	Keep away from sources of ignition - No smoking
S36/37 :	Wear suitable protective clothing and gloves
S45 :	In case of accident or if you feel unwell, seek medical advice (show the label where possible)

16 Other Information

The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

N.A. = NOT APPLICABLE
N.D. = NOT DETERMINED
* = INTERNAL CLASSIFICATION

Full text of any R-phrases referred to under heading 2:

R11 :	Highly flammable
R23/24/25 :	Toxic by inhalation, in contact with skin and if swallowed
R39/23/24/25 :	Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed

Exposure limits:

TLV :	Threshold Limit Value - ACGIH US 2000

OES :	Occupational Exposure Standards - United Kingdom 2001
MEL :	Maximum Exposure Limits - United Kingdom 2001
MAK :	Maximale Arbeitsplatzkonzentrationen - Germany 2001
TRK :	Technische Richtkonzentrationen - Germany 2001
MAC :	Maximale aanvaarde concentratie - the Netherlands 2002
VME :	Valeurs limites de Moyenne d'Exposition - France 1999
VLE :	Valeurs limites d'Exposition à court terme - France 1999
GWBB :	Grenswaarde beroepsmatige blootstelling - Belgium 1998
GWK :	Grenswaarde kortstondige blootstelling - Belgium 1998
EC :	Indicative occupational exposure limit values - directive 2000/39/EC

NOTE TO PHYSICIAN

Acute exposure to methanol, either through ingestion or breathing high airborne concentrations can result in symptoms appearing between 40 minutes and 72 hours after exposure. Symptoms and signs are usually limited to CNS, eyes and gastrointestinal tract. Because of the initial CNS's effects of headache, vertigo, lethargy and confusion, there may be an impression of ethanol intoxication.

Blurred vision, decreased acuity and photophobia are common complaints.

Treatment with ipecac or lavage is indicated in any patient presenting the symptoms within two hours of ingestion. A profound metabolic acidosis occurs in severe poisoning and serum bicarbonate levels are a more accurate measure of severity than serum methanol levels. Treatment protocols are available from most major hospitals and early collaboration with appropriate hospitals is recommended.

efoy.com

©EFOY is a registrated trademark of SFC Smart Fuel Cell AG.